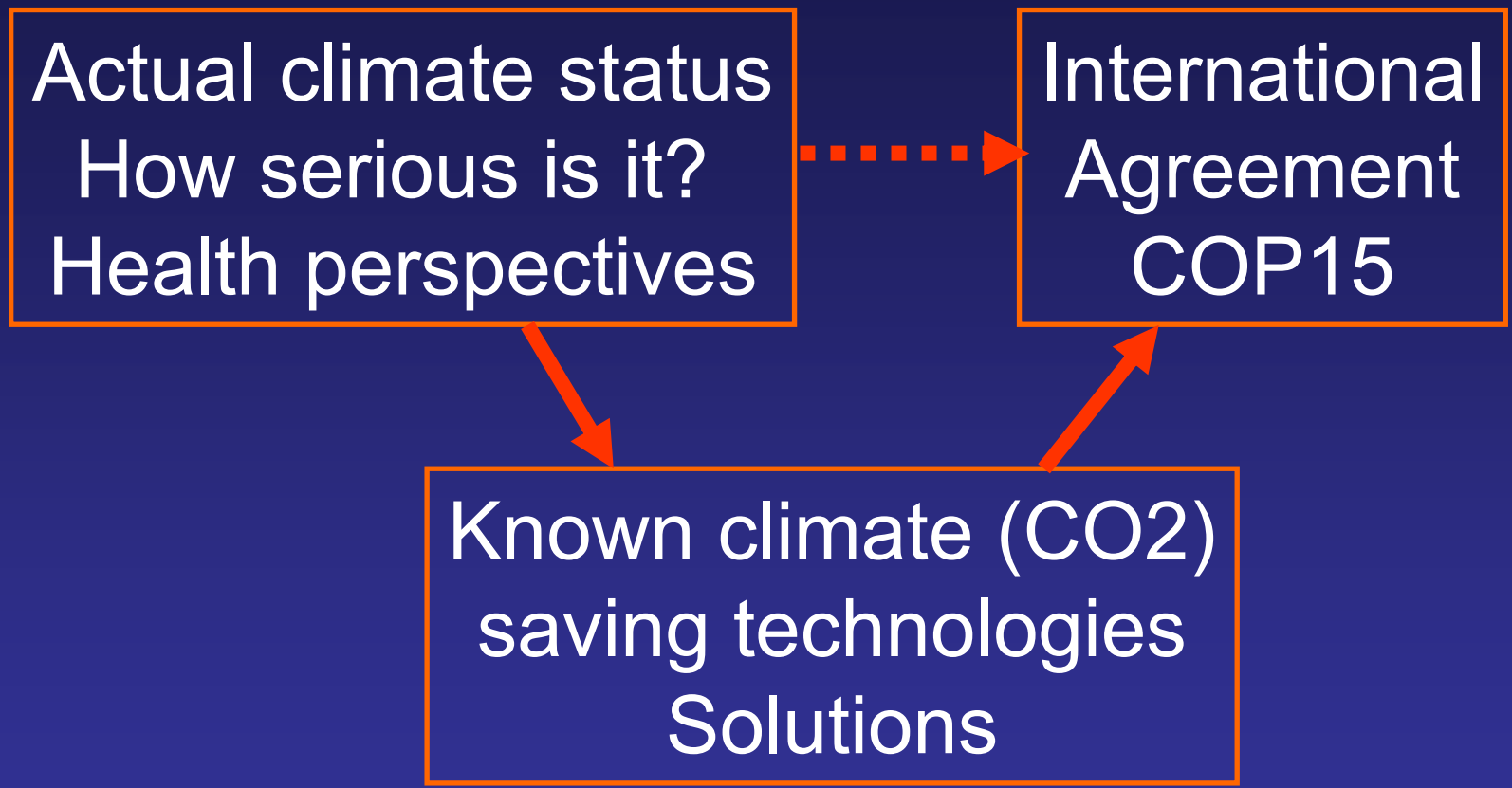
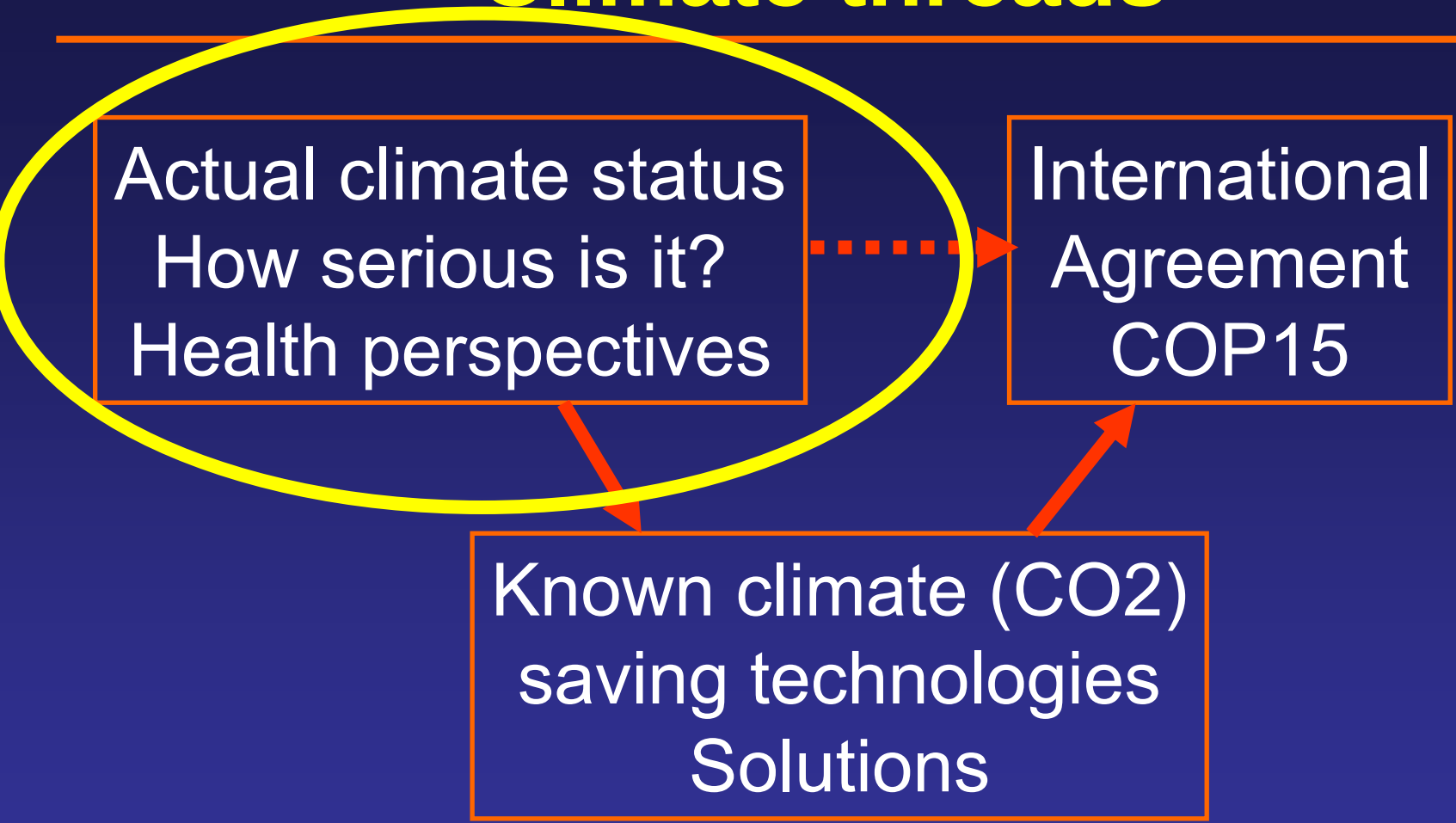
Climate threads



Climate threads



IPCC

- Integovernmental Panel on Climate Change
- World Meteorological Organization
- United Nations Environmental Programme

Published in 2007 a new climate report

IPCC Fourth Assessment Report (AR4)

- WG 1: The physical science basis
- WG 2: Impacts, adaptation and vulnerability
- WG 3: Mitigation of climate change
- The AR4 synthesis report (november 2007)

IPCC: www.ipcc.ch

United Nations Framework Convention on Climate Change

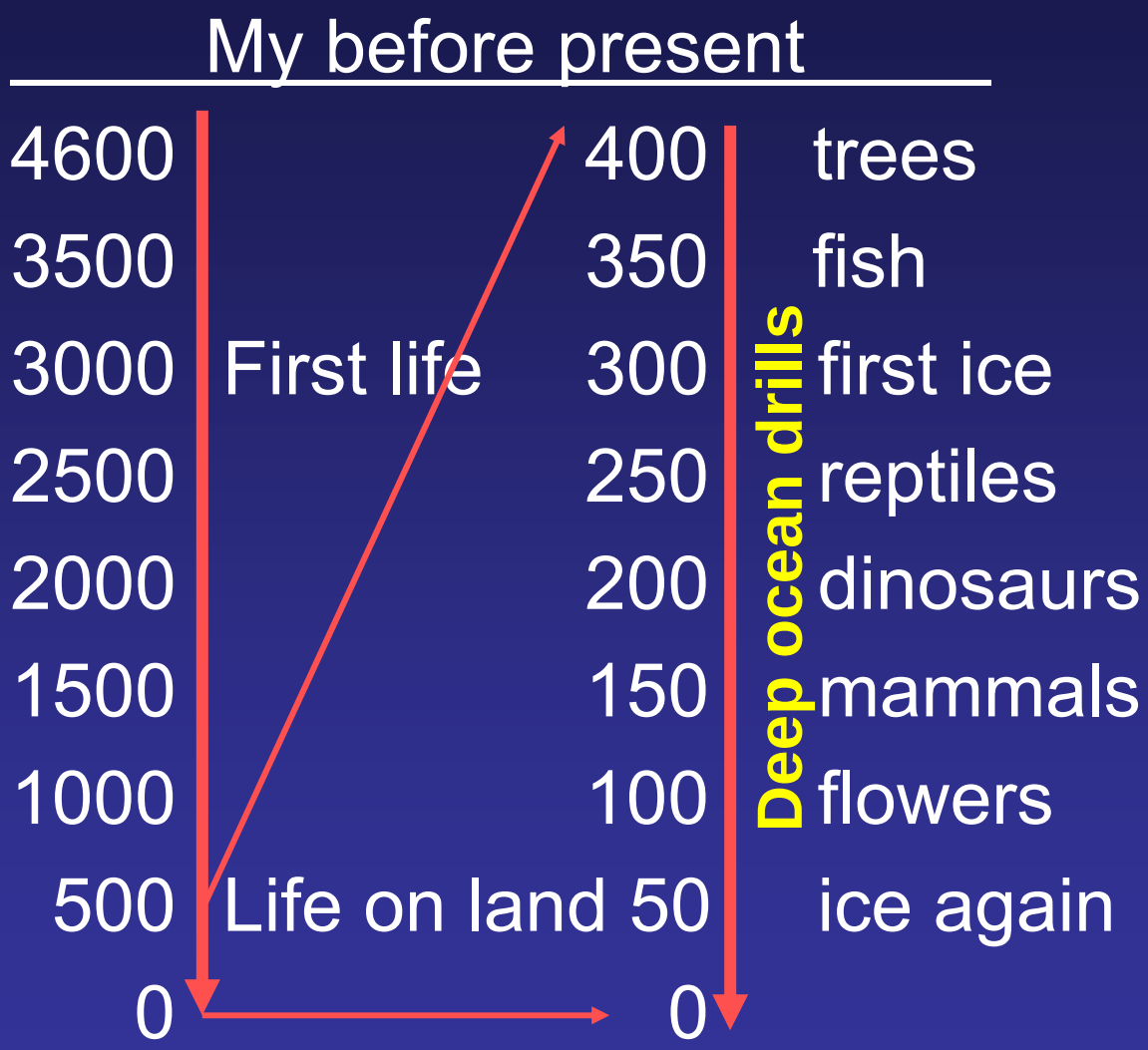
Aim is to stabilize greenhouse gas emissions…

"…at a level that would prevent dangerous anthropogenic interference with the climate system."

Earth development 4,600 My

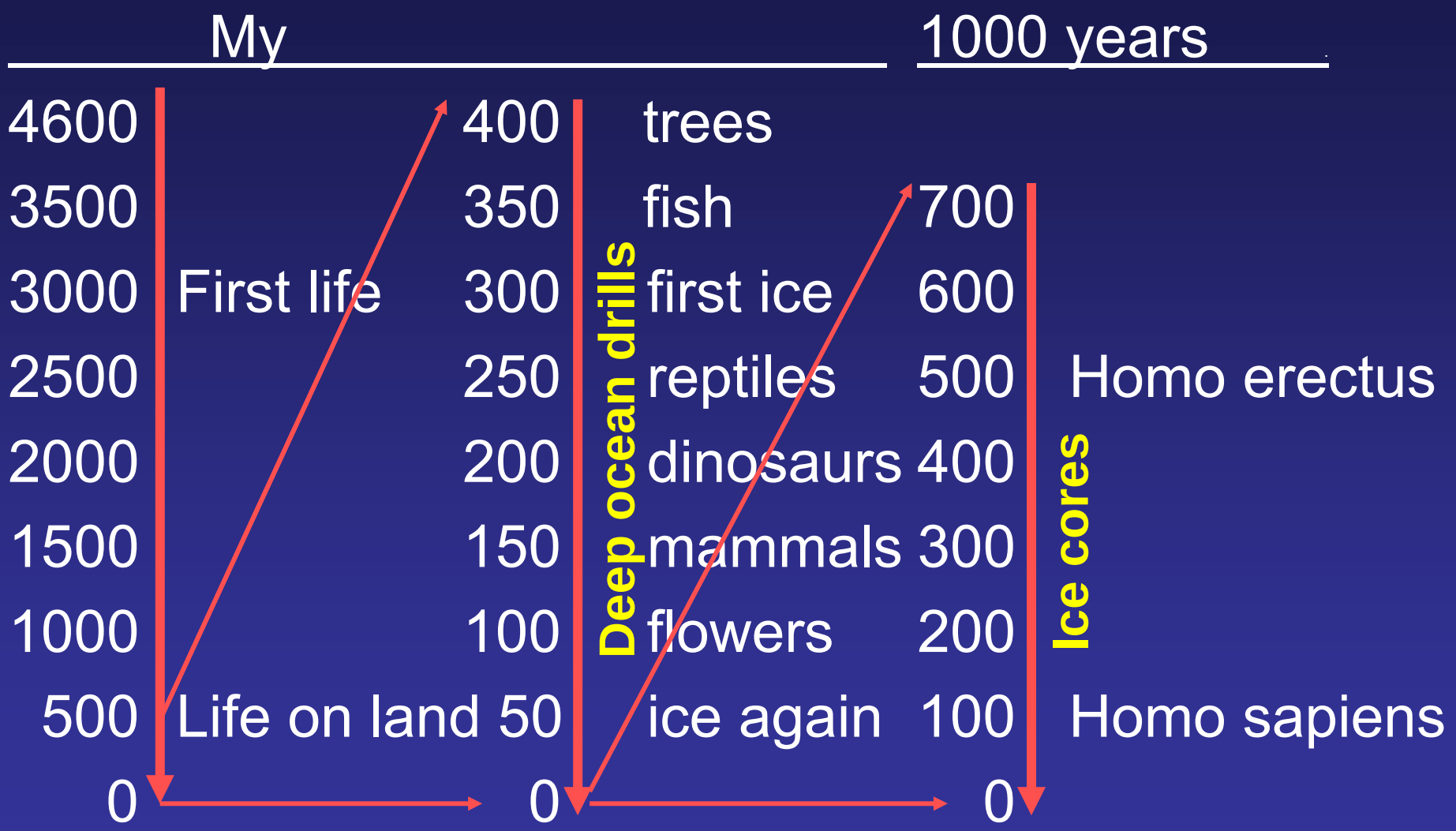
IPCC. Assessment report 4, 2007, *The Physical Science Basis*

Earth development 4,600 My



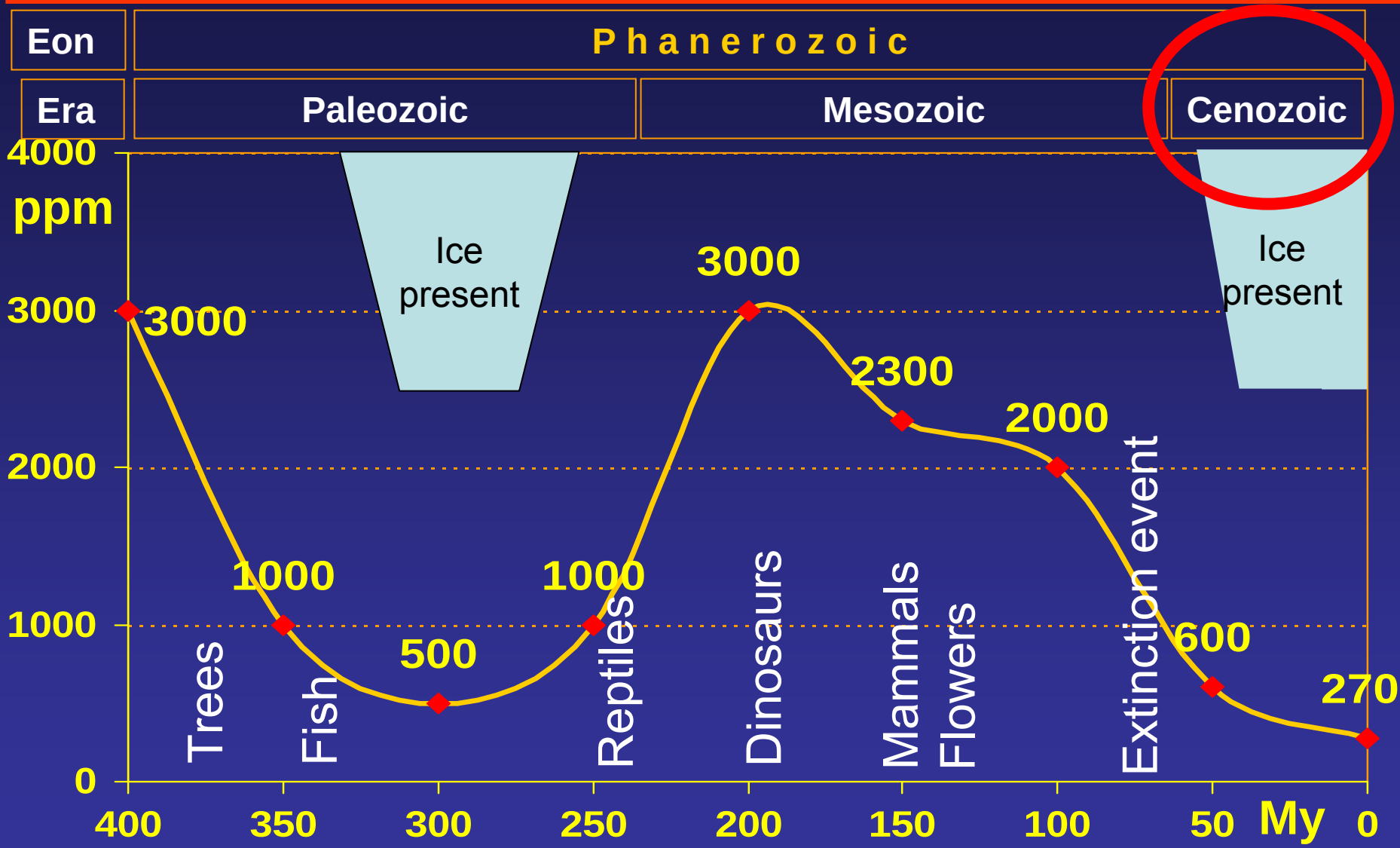
IPCC. Assessment report 4, 2007, *The Physical Science Basis*

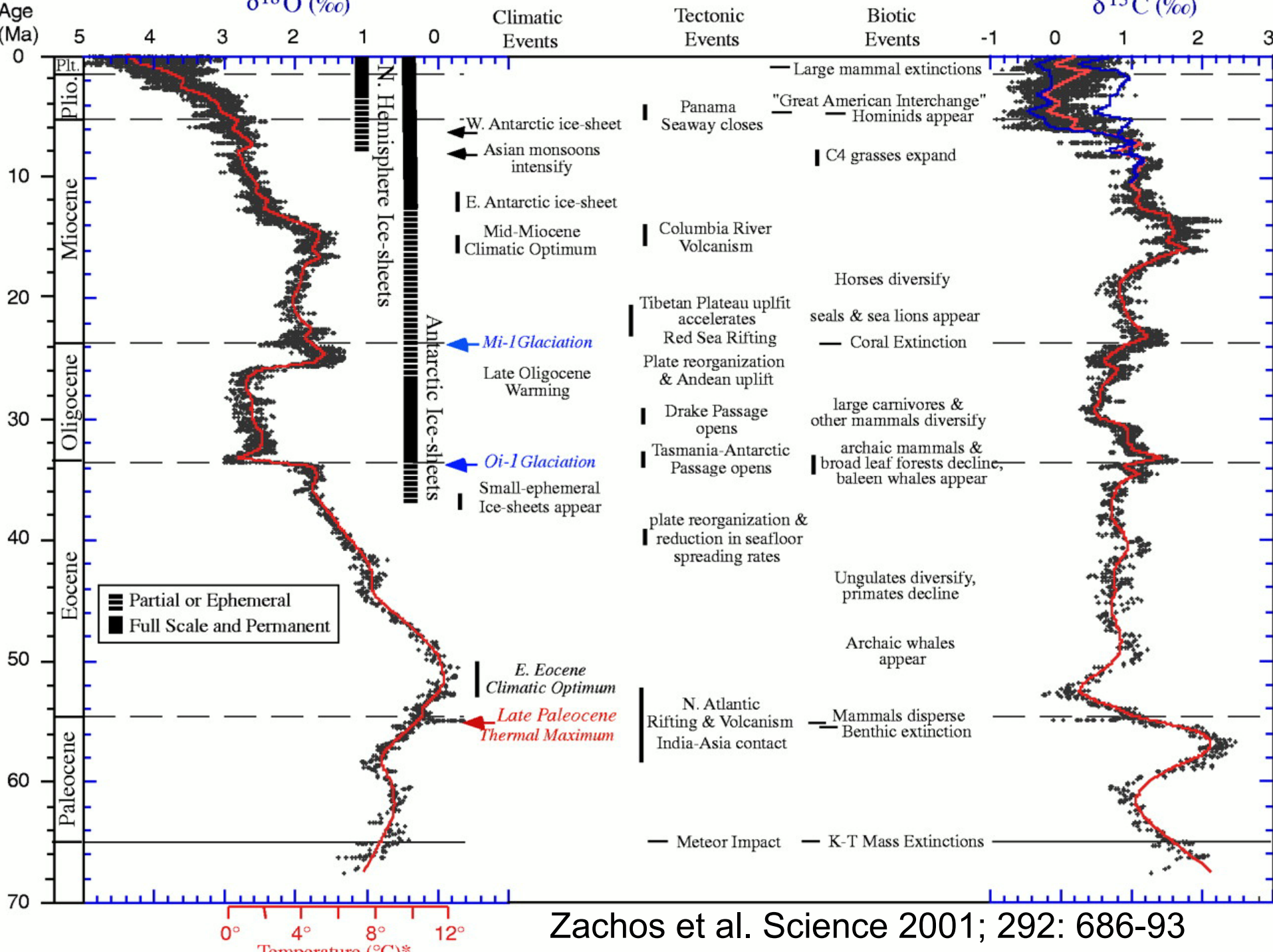
Earth development 4,600 My



IPCC. Assessment report 4, 2007, *The Physical Science Basis*

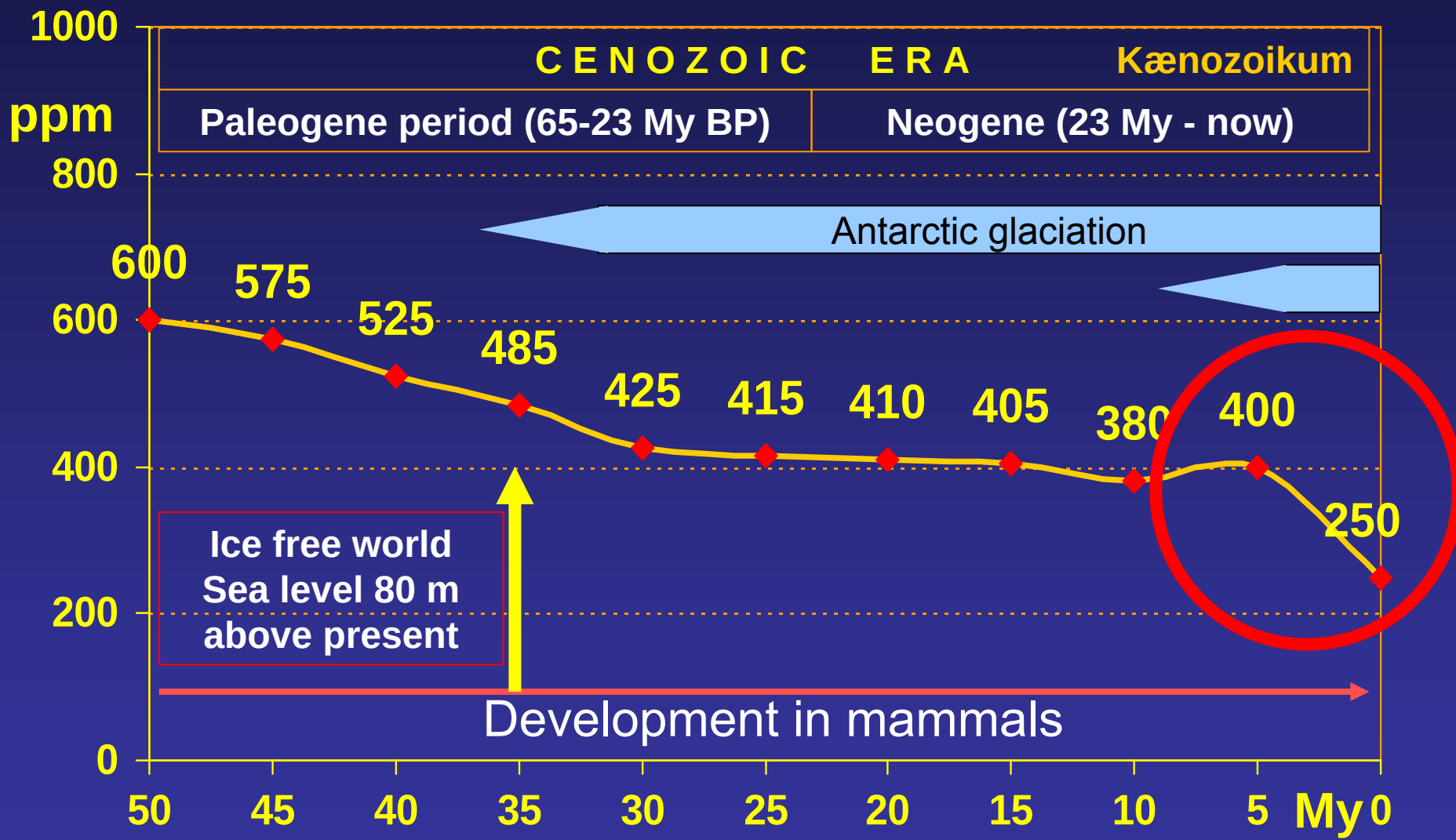
CO_2 in atmosphere through last 400 My





Zachos et al. Science 2001; 292: 686-93

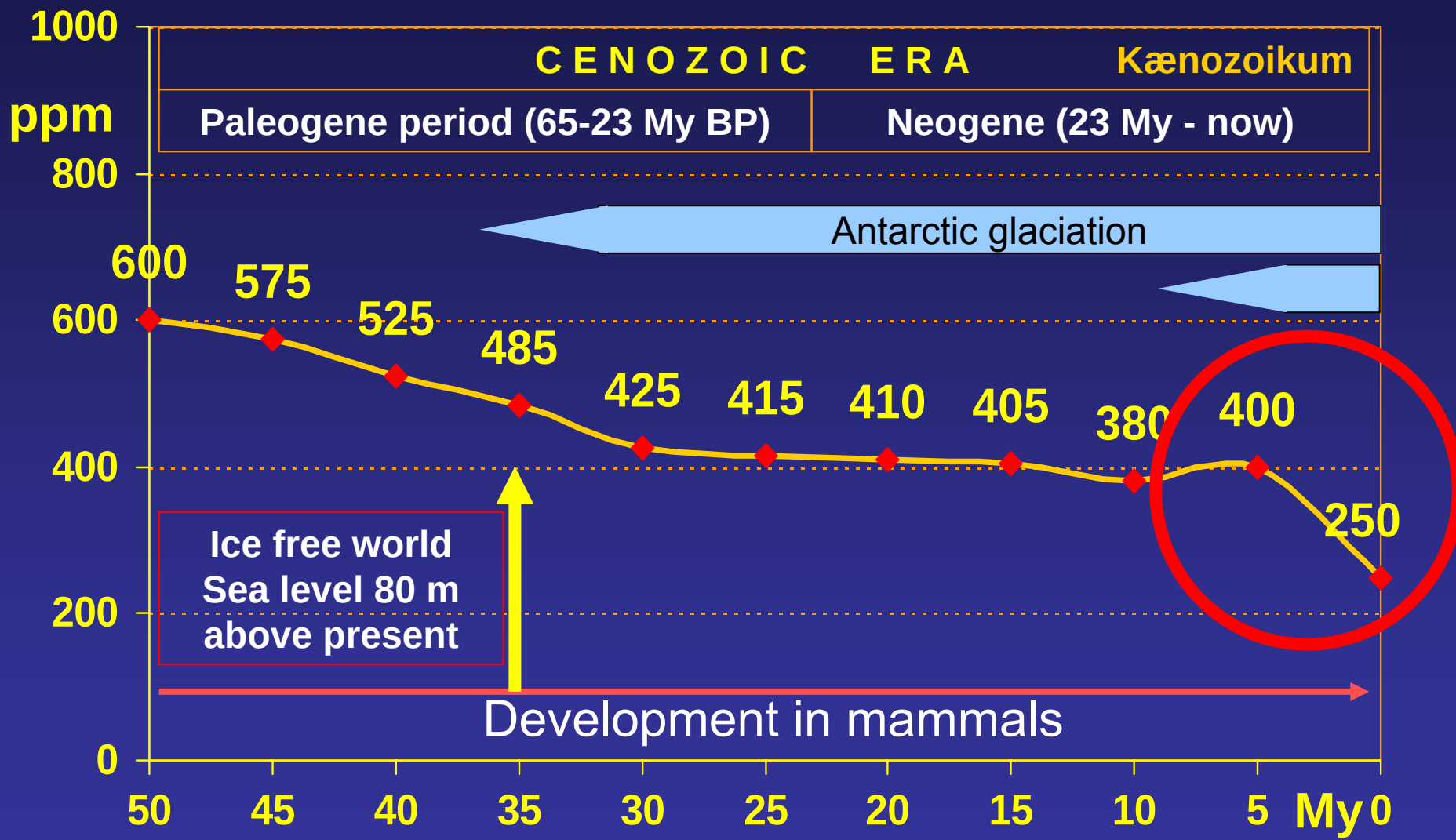
CO_2 in atmosphere through last 50 My



IPCC. Assessment report 4, 2007, *The Physical Science Basis*

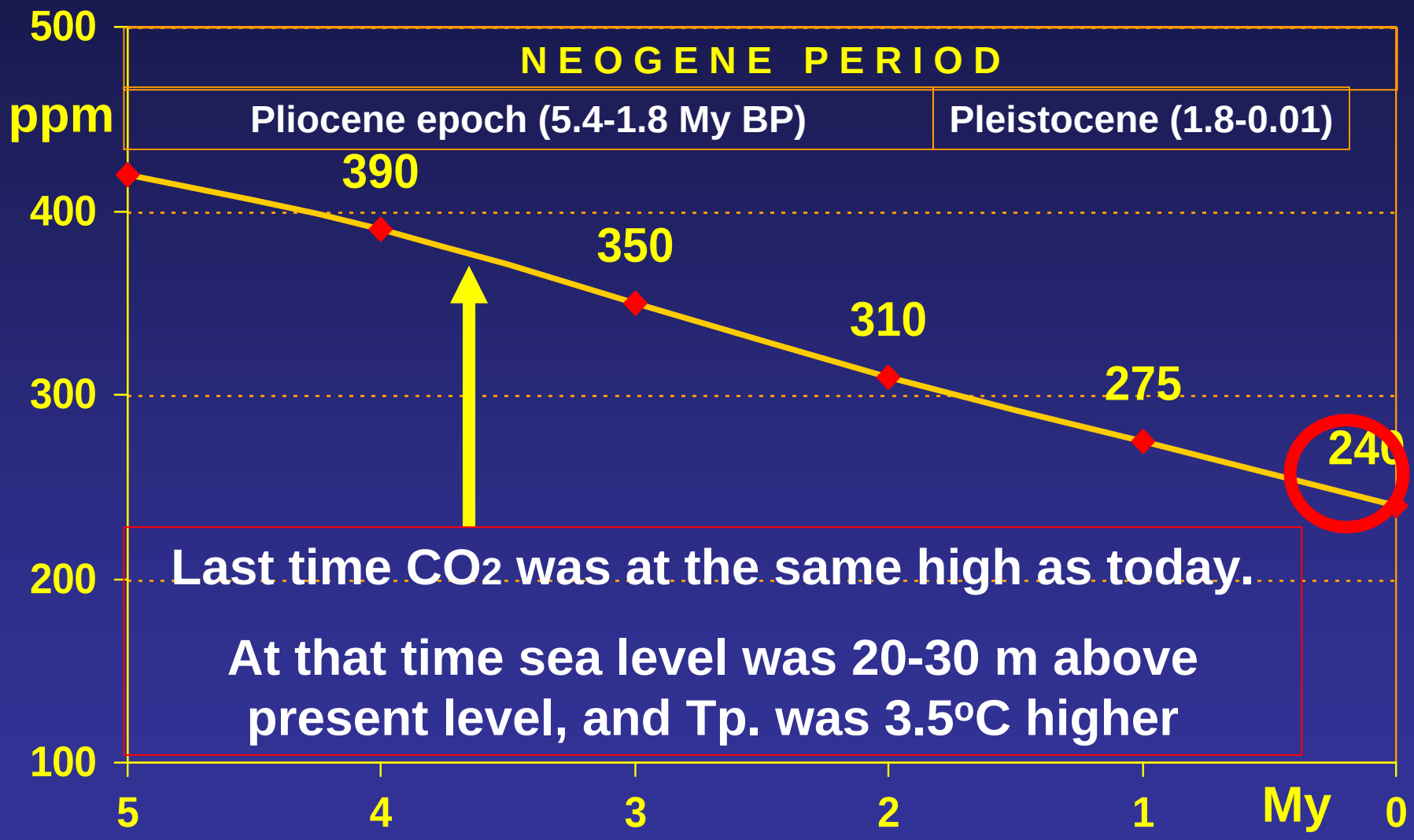
Paleogene (35 My BP)

CO_2 in atmosphere through last 50 My



IPCC. Assessment report 4, 2007, *The Physical Science Basis*

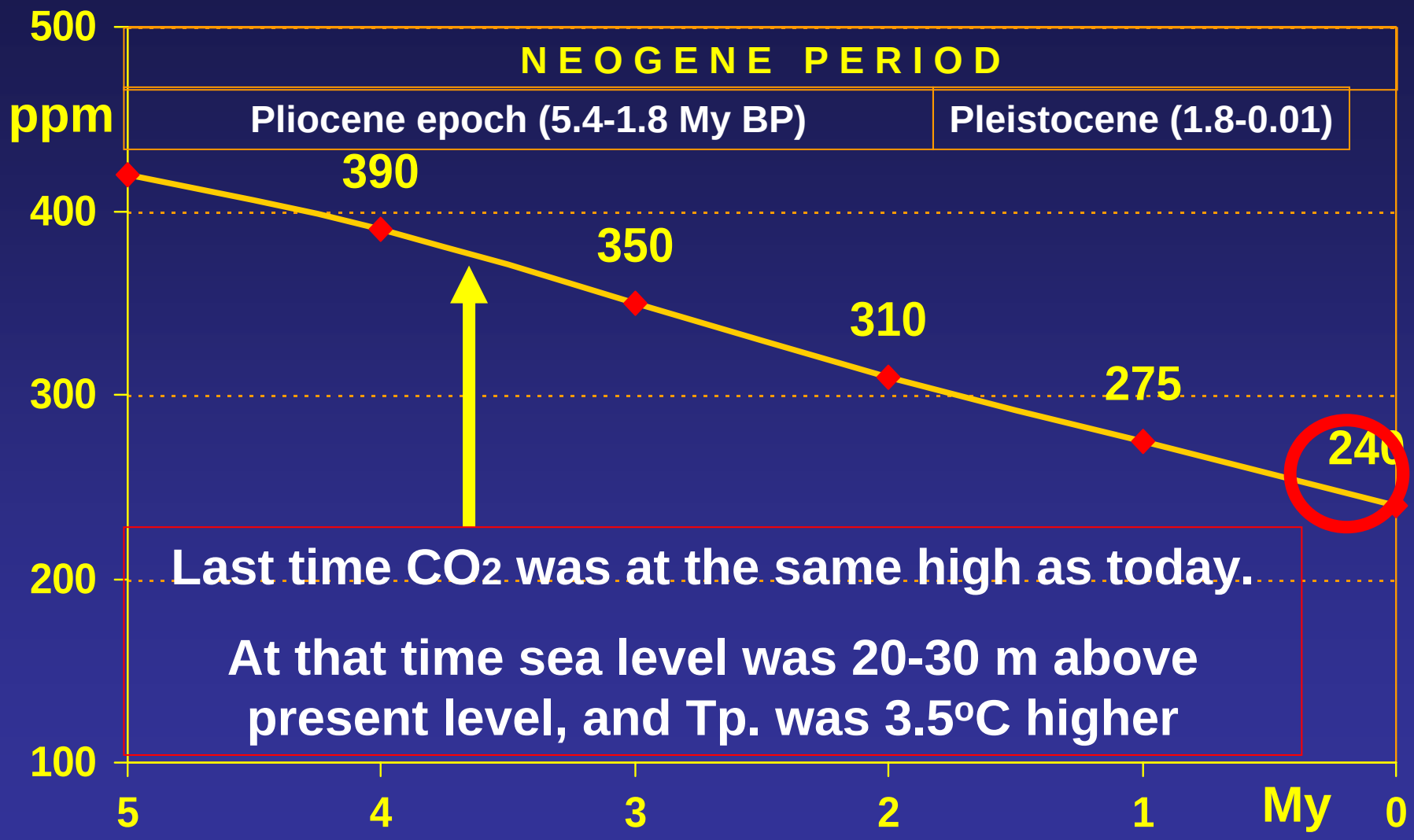
CO_2 in atmosphere through last 5 My



IPCC. Assessment report 4, 2007, *The Physical Science Basis*

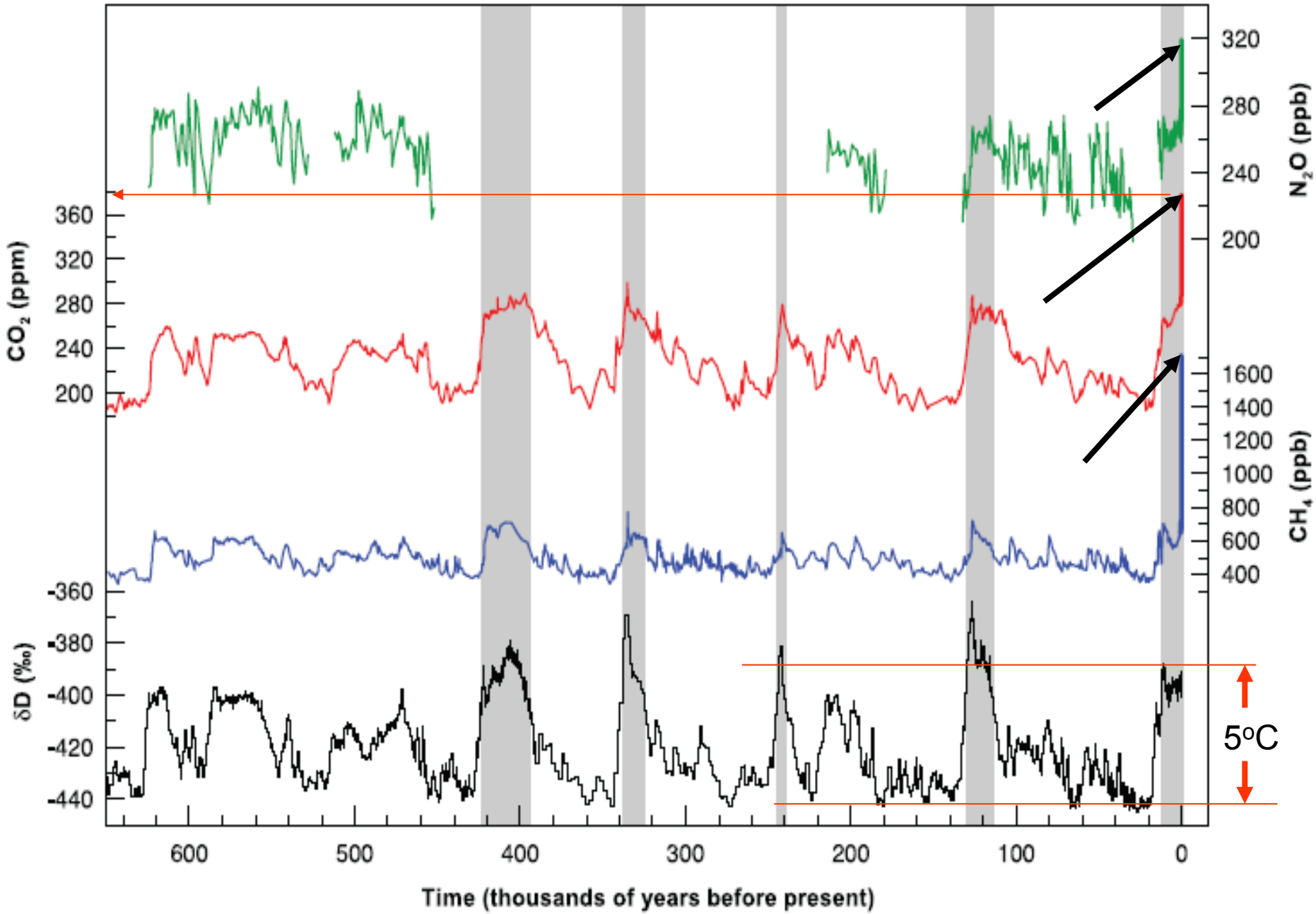
Pliocene (4 My BP)

CO_2 in atmosphere through last 5 My

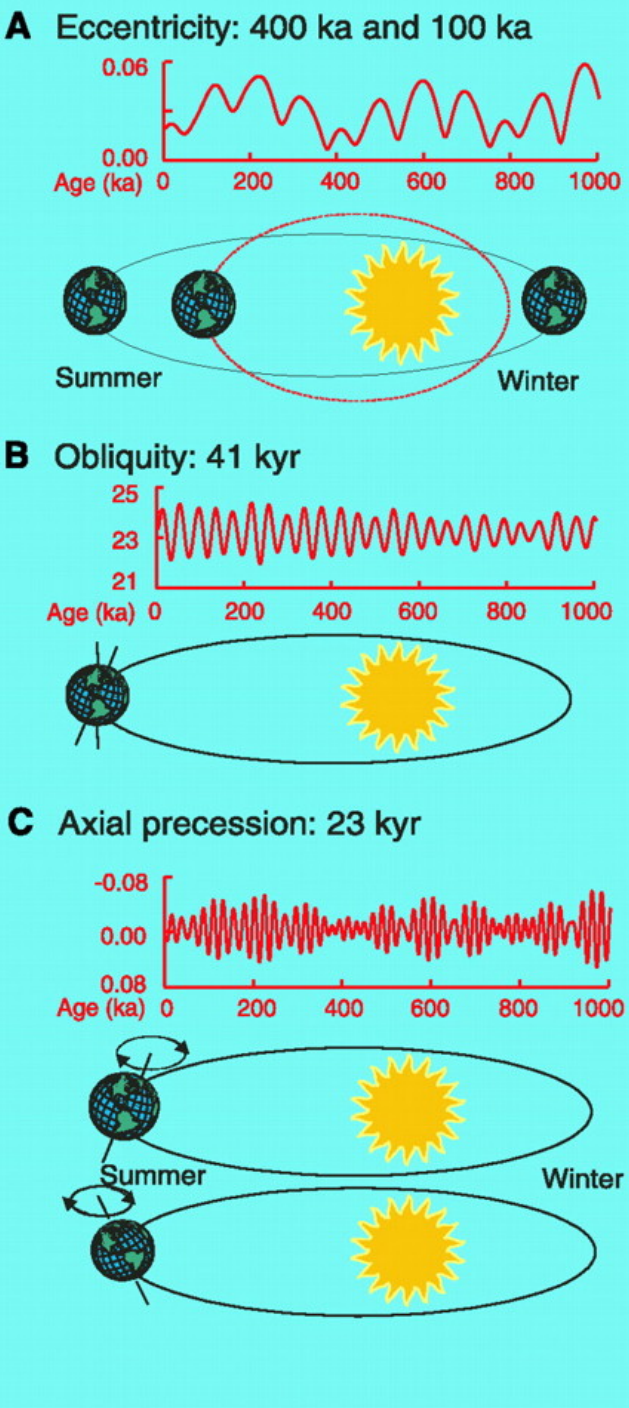


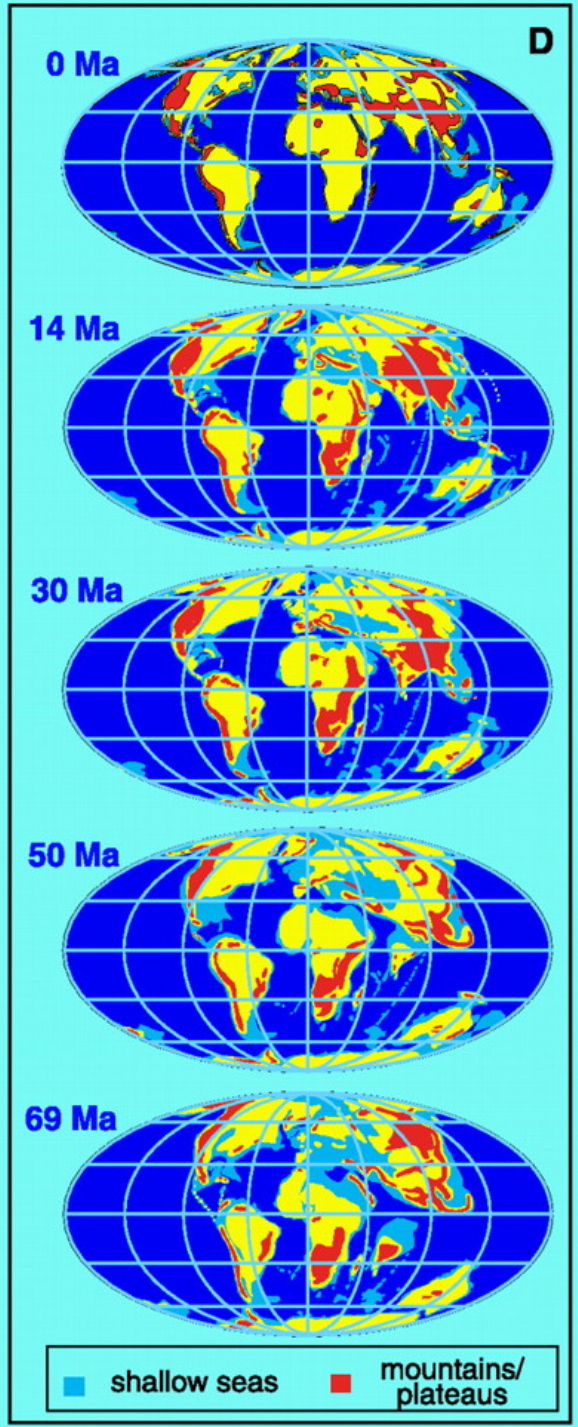
IPCC. Assessment report 4, 2007, *The Physical Science Basis*

CO2 and temperature through last 640,000 years



Orbital components





Cenozoic Paleo-Georgraphy

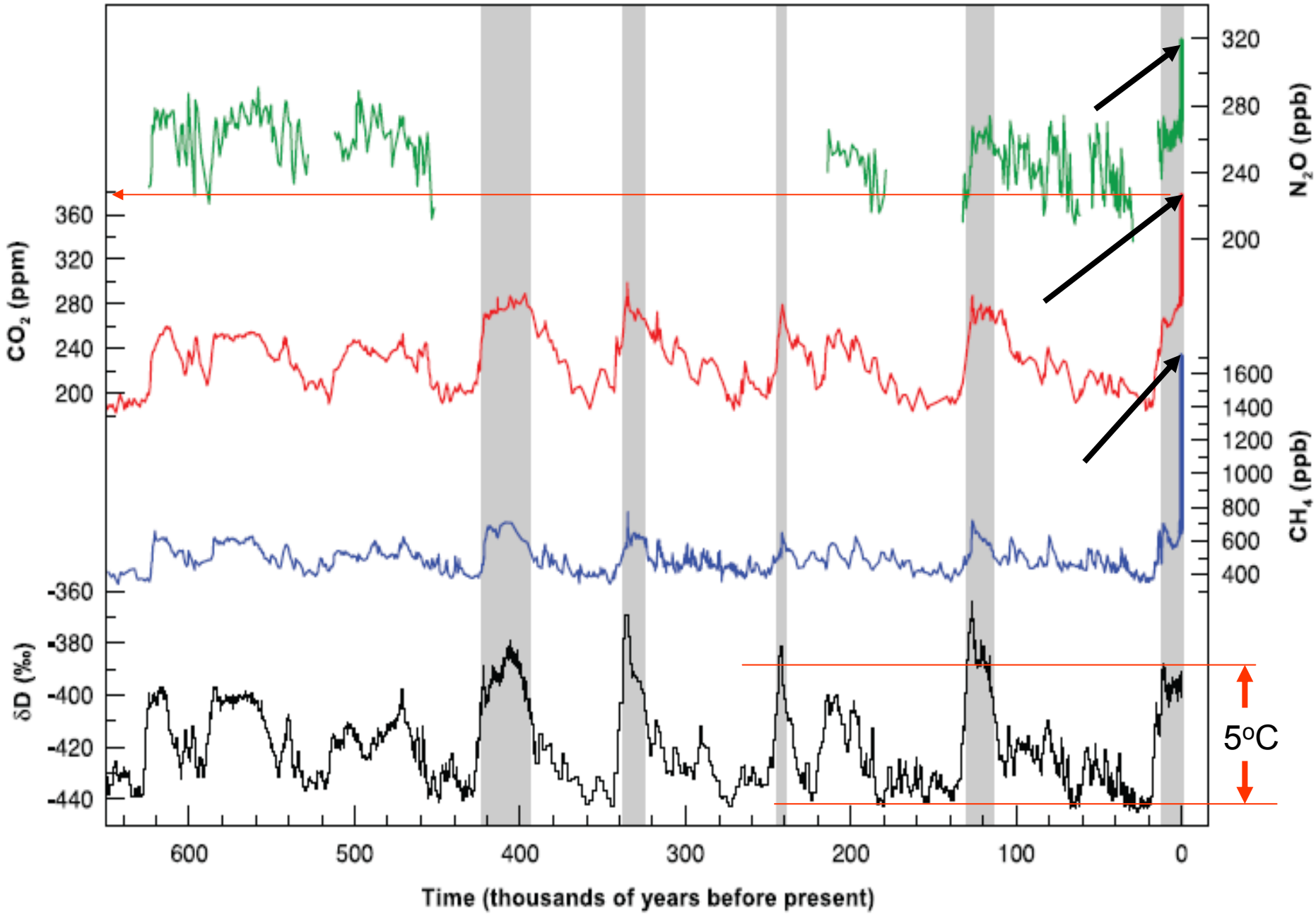
Zachos et al. Science 2001; 292: 686-93


Holocene


Holocene


Holocene

CO2 and temperature through last 640,000 years



Greenland surface ice melts

Melted ice descending into a vertical shaft carrying water to ice sheet base.

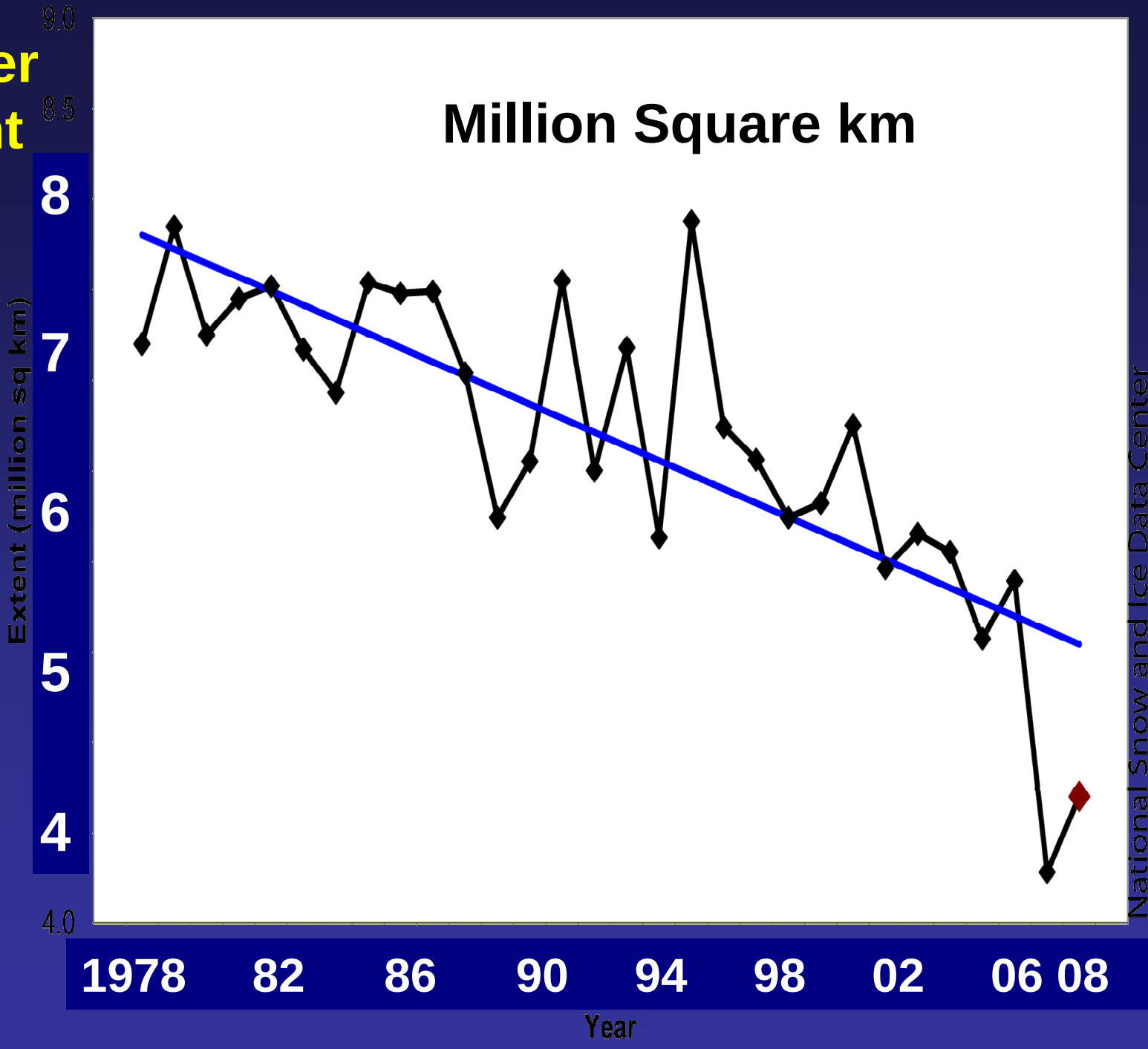
Source: Roger Braithwaite, University of Manchester (UK)

Ice stream Greenland

Discharge from major Greenland ice streams is accelerating markedly

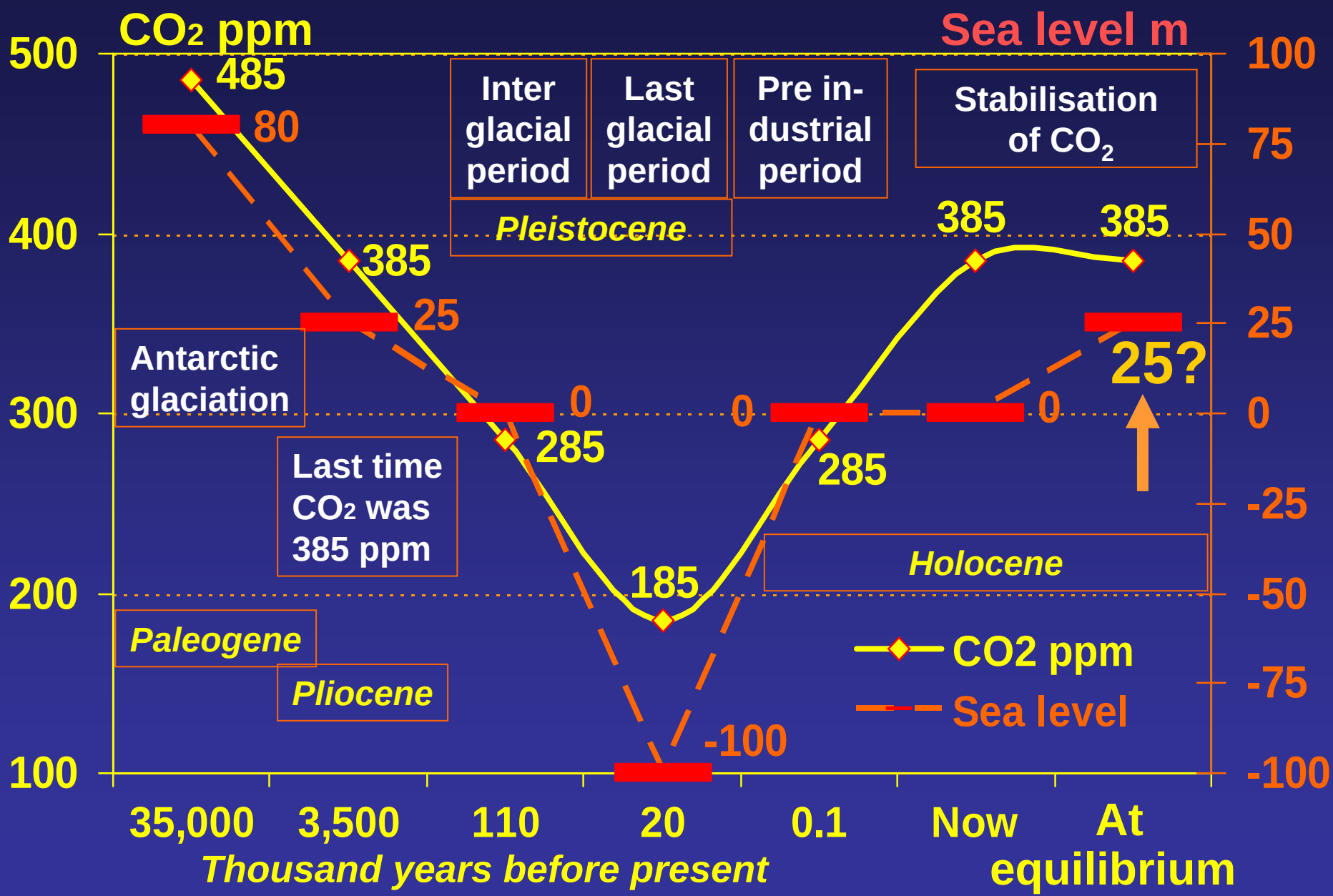
Source: Prof. Konrad Steffen, Univ. of Colorado

September ice extent



National Snow and Ice data Center
NSIDC
www.nsidc.org

CO_2 and sea level at equilibrium



Paleogene implications

- Dominant forcing: Natural ΔCO_2

  Natural rate: - 0.0001 ppm per year

  Human made rate: + 2.1 ppm per year

- Climate sensitivity high

  Antarctic ice forms when CO_2 <450 ppm

  Ice sheet formation reversible

  Ice sheet disintegrate when CO_2 increases

- Humans can produce “a different planet”

Earth sensitivity vs climate inertia

- Sensitivity expresses how much change a certain forcing brings
- High sensitivity is the opposite of high stability
- Inertia expresses how long time a certain change takes before a new equilibrium is established
- Climate changes through earth history: centuries or millennia
- Climate changes today: decades

James Hansen et al. Where should humanity aim?

United Nations Framework Convention on Climate Change

Aim is to stabilize greenhouse gas emissions…

"…at a level that would prevent dangerous anthropogenic interference with the climate system."

How to define “dangerous” change

Ice sheet disintegration: Global Sea level

- Long-term change from paleoclimate data
- Ice sheet response time probably decades

Regional climate disruptions

- Increase of extreme weather events
- Shifting zones – freshwater shortage
- Unsustainable migration rates (refugees)

Extermination of animal and plant species

- Extinction of polar and alpine species

James Hansen et al. Where should humanity aim?

Target CO_2

To preserve	Target CO_2 (ppm)
Arctic sea ice	300-325
Ice Sheets/Sea Level	300-350
Shifting Climatic Zones	300-350
Alpine Water Supplies	300-350
Avoid Ocean Acidification	300-350

Initial Target CO_2 = 350* ppm

James Hansen et al. Where should humanity aim?

CO_2 emissions per capita 2005

- An American: 23 tonnes per year
- A Danish: 13 tonnes per year
- A Chinese: 5.5 tonnes per year

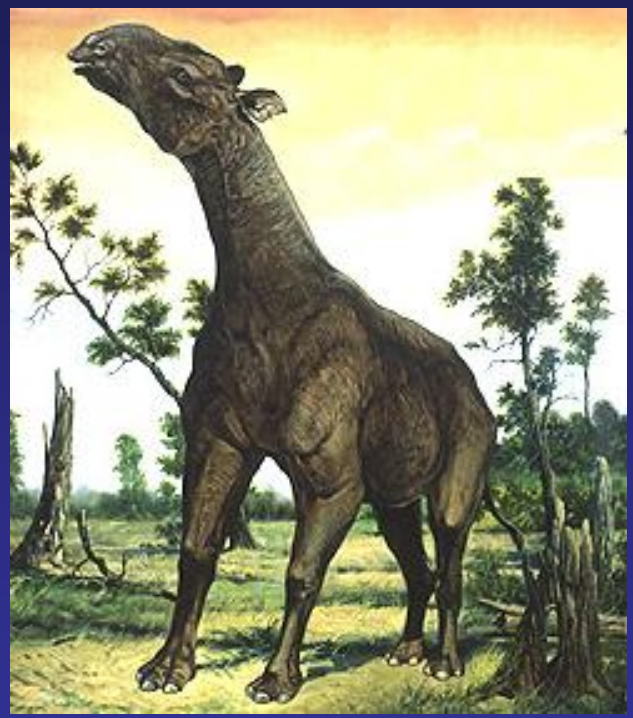
Stabilising atmospheric CO_2 at present level demands

- A mean emission of 1-2 tonnes per capita
- A reduction in the global emission of 75% before year 2050
- A reduction in our CO_2 emission of 90% before year 2050

Which CO_2 future?

485 ppm
Paleogene

385 ppm
Pliocene



285 ppm
Holocene

Climate and health

Health threads by climate changes are primarily a consequence of

- Damages after hurricanes and cyclones
- Homelessness for millions after flood
- Climate refugees, unsustainable migration
- Disintegration of civil infrastructures
- Shortage of drinking water
- Starvation

Climate and health

Climate change	Health consequence
Temperature rise	Tainted food, infections
Sea level rise, flood homelessness	Injuries, infections mental disorders, cholera
More rainfall, flood	do
Less rainfall,	Drought, reduced agrarian yield, starvation
Changed ocean streams	Depletion of fish stocks New fish stocks

McMichael et al. Lancet 2006; 367: 859-69

Tak

www.videnskab.dk/blogs

www.lidegaard.dk/slides

Geological time scale in My

Eng	Dansk	Example (english/dansk)
Eon	Æon	Phanerozoic ..zoikum 542->
Era	Æra	Cenozoic Kænozoikum 65->
Period	Periode	Paleogene Palæogen 65-23
		Neogene Neogen 23->
Epoch	Epoke	Pliocene Pliocæn 5.3-1.8
		Pleistocene 1.8-0.01
		Holocene 0.01->